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Contents lists available at ScienceDirect

Air Medical Journal

journal homepage: <http://www.airmedicaljournal.com/>

Original Research

The State of Neonatal and Pediatric Interfacility Transport During the Coronavirus Disease 2019 Pandemic



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A B S T R A C T

Objective: The coronavirus disease 2019 (COVID-19) pandemic has altered the provision of health care, including interfacility transport of critically ill neonatal and pediatrics patients. Transport medicine faces unique challenges in the care of persons infected with the severe acute respiratory syndrome coronavirus 2. In particular, the multitude of providers, confined spaces for prolonged time periods, varying modes (ground, rotor wing, and fixed wing) of transport, and the need for frequent aerosol-generating procedures place transport personnel at high risk. This study describes the clinical practices, personal protective equipment, and potential exposure risks of a large cohort of neonatal and pediatric interfacility transport teams.

Methods: Data for this study came from a survey distributed to members of the American Academy of Pediatrics Section on Transport Medicine.

Results: Fifty-four teams responded, and 47 reported transporting COVID-19–positive patients. Among the 47 teams, 25% indicated having at least 1 team member convert to COVID-19 positive. A small percentage of teams (40% ground, 40% fixed wing, and 18% rotor wing) reported allowing parental accompaniment during transport. There was no difference in teams with a positive team member among those that do (26%) and do not (25%) allow parents. There was a higher percentage of teams with a positive team member among teams that intubate (32% vs. 0%) and place laryngeal mask airways (34% vs. 0%) during transport.

Conclusion: Our study shows that exceptional care during interfacility transport, including a family-centered approach, can continue during the COVID-19 pandemic. Teams must take steps to protect themselves, as well as the patients and families they serve, in order to mitigate the transmission of the SARS-CoV-2 virus.

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The coronavirus disease 2019 (COVID-19) pandemic has affected every aspect of health care. As of mid-January 2021, there have been more than 23 million cases and 400,000 deaths in the United States. In the past year, we have learned that severe acute respiratory

syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for COVID-19, is highly transmissible (primarily by respiratory droplets), affects all ages of the population, and has strained health care systems across the globe.¹ Transport medicine faces unique challenges in the care of persons infected or persons under investigation (PUIs) for COVID-19. In particular, the multitude of providers, confined spaces for prolonged time periods, varying modes (ground, rotor wing, and fixed wing) of transport, and need for frequent aerosol-generating procedures place transport personnel at high risk of exposure. Several groups and societies have published recommendations on caring for COVID-19 patients or PUIs, including recommendations specific to transport.² However, there have been few publications describing experiences transporting PUIs or COVID-19 patients and none that describe the collective neonatal and pediatric interfacility

Supported by the Translational Research Institute grant UL1 TR003107 through the National Center for Advancing Translational Sciences of the National Institutes of Health.

We thank the members of the neonatal and pediatric transport community for their tireless work to care for neonates, infants, and children during the current pandemic. Your passion, dedication, and selfless service are truly inspiring.

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transport experience. Recommendations include the use of standardized intake forms,³ airway stabilization before transfer to avoid aerosol-generating procedures during transport,⁴ using appropriate personal protective equipment (PPE),^{5–7} and rigorous decontamination procedures.⁸ Risks to personnel must also be considered when deciding on the need for patient transport.⁹ The risk for transport team members includes personal safety as well as consequences of short staffing.¹⁰

The American Academy of Pediatrics Section on Transport Medicine (AAP-SOTM) frequently asked questions (FAQs) and the European consensus recommendations are the only documents that refer specifically to pediatric and neonatal transport.^{2,4} The European consensus recommendations suggest transporting pediatric patients without a parent or caregiver in order to protect the crew and minimize exposure to potentially infectious parents.⁴ However, the AAP-SOTM FAQs recommend considering parental accompaniment under certain circumstances.²

Understanding the current practices among neonatal and pediatric transport programs is critical to assess potential opportunities for continued education on safe practices and standards. This study used a survey developed to assess current practices among a large cohort of pediatric and neonatal transport programs who are actively transporting patients with known or suspected SARS-CoV-2.

Methods

The data for this study came from a survey distributed to members of the AAP-SOTM. The survey was distributed to members via the section's e-mail Listserv and social media page. The survey was open from August 3, 2020, through August 21, 2020, and included questions about PPE use, ventilation practices and filter use, and other transport-related and patient care questions. The survey was completed by 54 individuals, representing 54 unique transport teams. Among the 54 teams, 47 indicated they currently transport COVID-19 patients and are included in this study.

Given the small sample size, multivariate analyses were not feasible. Descriptive statistics include information about overall team characteristics as well as Fisher exact tests to assess differences in team characteristics by transport mode (ground, rotor wing, or fixed wing). Additionally, bivariate calculations using Fisher exact tests were conducted to assess whether there were differences in the percentages of teams with and without a COVID-19–positive team member based on different team-level characteristics and safety practices stratified by team method. Regressions and demographic tests were analyzed using Stata version 16 (StataCorp LLC, College Station, TX). All tests were 2-sided, assuming a *P* value of .05 as statistically significant; however, indicators of tests with *P* < .10 are additionally provided. This study was determined to be nonhuman subjects research by the University of Arkansas for Medical Sciences Institutional Review Board (#261931).

Results

Table 1 provides the characteristics of the 47 teams. Transport teams were located in all regions of the United States, with the highest percentage of teams located in the Midwest (34%) followed by the Southwest (19%), Northeast (19%), West (17%), and Southeast (9%). One team indicated a location outside the United States. The majority of teams (72%) transport pediatric and neonatal patients; 15% reported transporting only pediatric patients, and 13% reported transporting only neonatal patients. The most common team composition was a team of a registered nurse and a respiratory therapist (66%) followed by teams composed of a registered nurse and an emergency medical technician (15%). Among the 47 teams, 25.5% indicated having at least 1 team member convert to COVID-19 positive, of which 83.3% indicated that having a team member convert to positive resulted in staffing shortages.

Table 1

Team Characteristics Among Teams Transporting Coronavirus Disease 2019 (COVID-19) Patients

Characteristic	% (n)
Region	
Midwest	34 (16)
Southeast	9 (4)
Southwest	19 (9)
Northeast	19 (9)
West	17 (8)
Non-US	2 (1)
Team type	
Pediatric and neonatal	72 (34)
Pediatric only	15 (7)
Neonatal only	13 (6)
Team composition	
RN/RT	66 (31)
RN/EMT	15 (7)
RN/RN	4 (2)
EMT/EMT	13 (6)
Other	2 (1)
Team respiratory protection for COVID-19–positive patients	
Disposable N95	81 (38)
K95 or equivalent	11 (5)
PAPR or equivalent	9 (4)
Reuse of disposable masks	
No	53 (20)
Yes	47 (18)
Creative methods used for standard face mask	
No	84 (32)
Yes	16 (6)

EMT = emergency medical technician; PAPR = powered air-purifying respirator; RN = registered nurse; RT = respiratory therapist.

Table 2 provides the percent of ground, rotor wing, and fixed wing teams that answered “yes” or “no” to each of the outlined questions regarding PPE use and patient care activities. Fisher exact tests to test for differences in safety practices and patient care did not indicate any statistically significant differences in activities among different methods of transport (**Table 2**). When asked whether the team allowed parents during transport, 40% of ground teams and 40% of fixed wing teams allow parents compared with 18% of rotor wing teams (*P* < .10).

Team PPE

Over 80% of teams indicated using disposable N95 masks for their own protection when treating COVID-19 patients, of which 53% indicated reusing disposable masks for more than 1 patient (**Table 1**). Of note, among the teams that use KN95, a powered air-purifying respirator, or the equivalent, no team indicated having a positive team member. All teams with positive team members indicated using disposable N95 masks (results not shown). Around 30% of teams (ground: 36%, rotor wing: 31%, and fixed wing: 26%) use N95 masks or the equivalent when transporting all patients, regardless of COVID-19 status, compared with over 95% use of N95 masks (or equivalent) when transporting COVID-19–positive or suspected positive patients. Nearly all teams reported using eye protection (ground: 96%, rotor wing: 94%, and fixed wing: 91%), with fewer reporting use of level 3 gowns (ground: 83%, rotor wing: 74%, and fixed wing: 86%).

Patient PPE

The majority of teams of all 3 transport modes indicated that COVID-19–positive or suspected positive patients did not use an N95 or an equivalent mask with low-flow oxygen use (ground: 59%, rotor wing: 64%, and fixed wing: 67%) or high-flow oxygen use (ground: 61%, rotor wing: 64%, and fixed wing: 68%) (**Table 2**).

Table 2
Transport Team Coronavirus Disease 2019 (COVID-19) Safety Practices and Patient Care Activities

		Ground (n = 47), % (n)	Rotor Wing (n = 32), % (n)	Fixed Wing (n = 21), % (n)
If transporting COVID-19–positive patients, do you allow parents?	Yes	40 (19) ^a	18 (6) ^a	40 (10) ^a
	No	60 (28) ^a	82 (27) ^a	60 (15) ^a
For COVID-19–positive or suspected patients, if you allow parent/caregiver, do you require N95/equivalent for them?	Yes	26 (8)	26 (5)	13 (2)
	No	74 (23)	74 (14)	88 (14)
Do team members use N95/equivalent for ALL patient transports regardless of COVID-19 status or suspicion?	Yes	36 (17)	31 (11)	26 (7)
	No	64 (30)	69 (25)	74 (20)
Do team members use N95/equivalent for COVID-19–positive or suspected patients?	Yes	96 (44)	97 (30)	96 (23)
	No	4 (2)	3 (1)	4 (1)
Do team members use level 3 gowns for COVID-19–positive or suspected patients?	Yes	83 (39)	74 (23)	86 (23)
	No	17 (8)	26 (8)	14 (1)
Do team members use eye protection (shields/goggles) for COVID-19–positive or suspected patients?	Yes	96 (45)	94 (30)	91 (19)
	No	4 (2)	6 (2)	9 (3)
For COVID-19–positive or suspected patients on room air or low flow oxygen, does the patient wear N95 or equivalent?	Yes	41 (19)	36 (12)	33 (21)
	No	59 (27)	64 (21)	67 (2)
For COVID-19–positive or suspected patients on high flow oxygen, does patient wear N95 or equivalent?	Yes	39 (18)	36 (12)	32 (8)
	No	61 (28)	64 (21)	68 (16)
For COVID-19–positive patients on CPAP/BIPAP, is there an effort to change modality prior to transport?	Yes	33 (15)	47 (16)	48 (7)
	No	67 (31)	53 (28)	52 (15)
For COVID-19–positive or suspected patients on conventional vent, do you use an in-line HEPA filter?	Yes	98 (45)	100 (33)	100 (24)
	No	2 (1)	0 (0)	0 (0)
For COVID-19–positive or suspected patients on conventional vent, do you use ANY in-line filter?	Yes	95 (40)	97 (28)	95 (19)
	No	5 (2)	3 (1)	5 (1)
For COVID-19–positive or suspected patients on HFOV, do you attempt to use an in-line HEPA filter?	Yes	58 (25)	66 (19)	50 (11)
	No	42 (18)	34 (10)	50 (11)
For COVID-19–positive or suspected patients on HFOV, do you use ANY type of in-line filter?	Yes	63 (20)	67 (16)	64 (9)
	No	38 (12)	33 (8)	36 (5)
For any vented COVID-19–positive or suspected patient, do you administer aerosols?	Yes	33 (15)	34 (11)	32 (7)
	No	67 (30)	66 (21)	68 (15)
For any vented COVID-19–positive or suspected patient, will you place an advanced airway (intubate) during transport?	Yes	83 (38)	88 (29)	87 (20)
	No	17 (8)	12 (4)	13 (3)
For any vented COVID-19–positive or suspected patient, will you place an LMA during transport?	Yes	76 (35)	82 (27)	83 (19)
	No	24 (11)	18 (6)	17 (4)
For any vented COVID-19–positive or suspected patient, will you provide CPR during transport?	Yes	93 (43)	94 (30)	96 (22)
	No	7 (3)	6 (2)	4 (1)

BIPAP = bilevel positive airway pressure; CPAP = continuous positive airway pressure; CPR = cardiopulmonary resuscitation; HEPA = high-efficiency particulate air; HFOV = high-frequency oscillatory ventilation; LMA = laryngeal mask airway.

^a $P < .10$ using the Fisher exact test.

Ventilation-Related Activities

Few teams indicated not using an in-line high-efficiency particulate air (HEPA) filter when transporting COVID-19–positive or suspected positive patients on a conventional mechanical ventilator (ground: 2%, rotor wing: 0%, and fixed wing: 0%) (Table 2). A higher percentage of teams indicated not using an in-line HEPA filter when transporting COVID-19–positive or suspected positive patients requiring high-frequency oscillatory ventilation (ground: 38%, rotor wing: 33%, and fixed wing: 36%). Around one third of ground (33%), rotor wing (34%), and fixed wing (32%) teams indicated aerosol administration for COVID-19–positive or suspected positive patients (Table 2). Around 80% to 90% of teams (ground: 83%, rotor wing: 88%, and fixed wing: 87%) indicated they intubate and/or place a laryngeal mask airway (LMA) during transport (ground: 76%, rotor wing: 82%, and fixed wing: 83%). Approximately 5% of teams indicated they do not provide cardiopulmonary resuscitation during transport (ground: 7%, rotor wing: 6%, and fixed wing: 4%).

Teams With a Positive Team Member

Table 3 provides the percent of teams that indicated having at least 1 team member convert to COVID-19 positive. The percentages add up to 100% within each transport team and within each “yes” or “no” response. For example, among teams that allow parents during transport, 26% had at least 1 positive team member compared with 25% among transport teams that indicated they do not allow parents during transport. Assessments using the Fisher exact test suggest there was a higher percentage of teams with at least 1 positive member among ground teams who intubate during transport (32% vs. 0%,

$P < .10$), ground teams who place an LMA during transport (34% vs. 0%, $P < .05$), and rotor wing teams who place an LMA during transport (41% vs. 0%, $P < .10$).

Discussion

Our study is the first to describe the clinical practices, PPE use, and potential risk factors associated with interfacility transport of neonatal and pediatric patients via ground, rotor wing, and fixed wing vehicles during the COVID-19 pandemic. We collected data regarding the practices of 47 pediatric, neonatal, and mixed pediatric/neonatal transport programs across the United States and abroad in order to obtain a better understanding of the current practices among pediatric and neonatal transport teams. The interfacility transport of critically ill neonatal and pediatric patients is a complex task that specialized transport teams conduct safely and efficiently.¹¹ The transport of critically ill neonatal and pediatric patients allows for state-of-the-art care only available at tertiary care centers. The rampant global spread of the SARS-CoV-2 virus has further complicated the safe delivery of critically ill patients in an already austere environment. The known increased asymptomatic and presymptomatic carriage rate of the SARS-CoV-2 virus in young children and the frequent need to provide aerosolizing procedures for respiratory distress and respiratory failure provide further risk to transport team members.¹² Given the limited number of pediatric and neonatal transport teams, infection during interfacility transport puts not only transport team personnel at potential risk but also limits on staffing can have impacts on the transport of pediatric patients with COVID-19 as well as other critically ill children and neonates.

Table 3
The Percent of Teams With a Positive Coronavirus Disease 2019 (COVID-19) Team Member by Transport Team COVID-19 Safety Practices and Patient Care Activities

		Ground(n = 47)		Rotor Wing(n = 32)		Fixed Wing(n = 21)	
		COVID-19–Positive Team Member, % (n)	No COVID-19–Positive Team Member, % (n)	COVID-19–Positive Team Member, % (n)	No COVID-19–Positive Team Member, % (n)	COVID-19–Positive Team Member, % (n)	No COVID-19–Positive Team Member, % (n)
If transporting COVID-19–positive patients, do you allow parents?	Yes	26 (5)	74 (14)	50 (3)	50 (3)	40 (4)	60 (6)
	No	25 (7)	75 (21)	30 (8)	70 (19)	40 (6)	60 (9)
For COVID-19–positive or suspected patients, if you allow parent/caregiver, do you require N95/equivalent for them?	Yes	25 (2)	75 (6)	40 (2)	60 (3)	50 (1)	50 (1)
	No	43 (10)	57 (13)	50 (7)	50 (7)	43 (6)	57 (8)
Do team members use N95/equivalent for ALL patient transports regardless of COVID-19 status or suspicion?	Yes	35 (6)	65 (11)	36 (4)	64 (7)	57 (4)	43 (3)
	No	20 (6)	80 (24)	28 (7)	72 (18)	30 (6)	70 (14)
Do team members use N95/equivalent for COVID-19 –positive or suspected patients?	Yes	25 (11)	75 (33)	33 (10)	67 (20)	43 (10)	57 (13)
	No	50 (1)	50 (1)	100 (1)	0 (0)	0 (0)	100 (1)
Do team members use level 3 gowns for COVID-19–positive or suspected patients?	Yes	26 (10)	74 (29)	35 (8)	65 (15)	42 (8)	58 (11)
	No	25 (2)	75 (6)	38 (3)	63 (5)	33 (1)	67 (2)
Do team members use eye protection (shields/goggles) for COVID-19–positive or suspected patients?	Yes	27 (12)	73 (33)	37 (11)	63 (19)	43 (9)	57 (12)
	No	0 (0)	100 (2)	0 (0)	100 (2)	0 (0)	100 (2)
For COVID-19–positive or suspected patients on room air or low-flow oxygen, does the patient wear N95 or equivalent?	Yes	16 (3)	84 (16)	17 (2)	83 (10)	25 (2)	75 (6)
	No	33 (9)	67 (18)	43 (9)	57 (12)	50 (8)	50 (8)
For COVID-19–positive or suspected patients on high flow oxygen, does patient wear N95 or equivalent?	Yes	17 (3)	83 (15)	17 (2)	83 (10)	14 (1)	86 (6)
	No	32 (9)	68 (19)	43 (9)	57 (12)	47 (7)	53 (8)
For COVID-19–positive patients on CPAP/BIPAP, is there an effort to change modality prior to transport?	Yes	33 (5)	67 (10)	31 (5)	69 (11)	27 (3)	73 (8)
	No	23 (7)	77 (24)	33 (6)	67 (12)	50 (6)	50 (6)
For COVID-19–positive or suspected patients on conventional vent, do you use an in-line HEPA filter?	Yes	27 (12)	73 (33)	33 (11)	67 (22)	38 (9)	63 (15)
	No	0 (0)	100 (1)	—	—	—	—
For COVID-19–positive or suspected patients on conventional vent, do you use ANY in-line filter?	Yes	25 (10)	75 (30)	32 (9)	68 (19)	37 (7)	63 (12)
	No	50 (1)	50 (1)	100 (1)	0 (0)	100 (1)	0 (0)
For COVID-19–positive or suspected patients on HFOV, do you attempt to use an in-line HEPA filter?	Yes	32 (8)	68 (17)	42 (8)	58 (11)	55 (6)	45 (5)
	No	22 (4)	78 (14)	30 (3)	70 (7)	27 (3)	73 (8)
For COVID-19–positive or suspected patients on HFOV, do you use ANY type of in-line filter?	Yes	35 (7)	65 (13)	44 (7)	56 (9)	67 (6)	33 (3)
	No	25 (3)	75 (9)	38 (3)	63 (5)	40 (2)	60 (3)
For any vented COVID-19–positive or suspected patient, do you administer aerosols?	Yes	13 (2)	87 (13)	18 (2)	82 (9)	29 (2)	71 (5)
	No	33 (10)	67 (20)	43 (9)	57 (12)	47 (7)	53 (8)
For any vented COVID-19–positive or suspected patient, will you place an advanced airway (intubate) during transport?	Yes	32 (12) ^a	68 (26) ^a	38 (11)	62 (18)	45 (9)	55 (11)
	No	0 (0) ^a	100 (8) ^a	0 (0)	100 (4)	0 (0)	100 (3)
For any vented COVID-19–positive or suspected patient, will you place an LMA during transport?	Yes	34 (12) ^b	66 (23) ^b	41 (11) ^a	59 (16) ^a	47 (9)	53 (10)
	No	0 (0) ^b	100 (11) ^b	0 (0) ^a	100 (6) ^a	0 (0)	100 (4)
For any vented COVID-19–positive or suspected patient, will you provide CPR during transport?	Yes	28 (12)	72 (31)	37 (11)	63 (19)	41 (9)	59 (13)
	No	0 (0)	100 (3)	0 (0)	100 (2)	0 (0)	100 (1)

BIPAP = bilevel positive airway pressure; CPAP = continuous positive airway pressure; CPR = cardiopulmonary resuscitation; HEPA = high-efficiency particulate air; HFOV = high-frequency oscillatory ventilation; LMA = laryngeal mask airway.

^a $P < .05$ using the Fisher exact test.

^b $P < .10$ using the Fisher exact test.

Family-Centered Care During Transport

Family-centered care has been shown to improve patient and family outcomes, improve both family and professional satisfaction, decrease health care costs, and lead to more efficient use of health care resources.¹³ A family-centered care approach has become standard practice at children's hospitals. The benefits of such an approach to care in the neonatal and pediatric intensive care units have been demonstrated in previous studies.¹⁴ Neonatal and pediatric interfacility transport teams are the link between referring hospitals and tertiary care centers. Children's hospital-based family-centered care starts with the interfacility transport team, and benefits of family-centered care have been shown in neonatal¹⁵ and pediatric transport.¹⁶ The majority of interfacility transport programs allow parental presence during ground and fixed wing transport. Parental presence during rotor wing transport is not as common, although many programs with large rotor wing aircraft also allow parental accompaniment.

The COVID-19 pandemic has changed many aspects of care provision for neonatal and pediatric patients, including limitations to the family-centered care approach. Although some limitations are necessary to prevent the spread of the SARS-CoV-2 virus, the benefits of family-centered care are nonetheless important. Our study shows that the COVID-19 pandemic has impacted the family-centered care approach to neonatal and pediatric interfacility transport, with 40% of ground teams, 39% of fixed wing teams, and 18% of rotor wing teams indicating parental presence during neonatal and pediatric transport. Of the teams that allow parents during transport, we found no increased risk of team members converting to COVID-19 positive; 26% of teams that do allow parents had a positive team member versus 25% of teams that do not allow parents. Although precautions such as screening parents for symptoms, parental masking, and physical distancing in vehicles when possible must be considered, teams should consider the known benefits of a family-centered care approach to interfacility transport during the COVID-19 pandemic. The present study suggests that a family-centered care approach may not place team members at increased risk of contracting the SARS-CoV-2 virus, providing evidence for the previously published family-centered care recommendation from the AAP-SOTM.² Between 50% to 75% of teams require parents who accompany the transport to wear an N95 or an equivalent mask during transport.

PPE

Health care personnel (HCP) involved in the care of COVID-19–positive patients and suspected patients are at increased risk of contracting the SARS-CoV-2 virus. Proper PPE usage is an important factor in limiting spread, and the Centers for Disease Control and Prevention (CDC) has provided PPE guidance for HCP, patients, and visitors.¹⁷ Patients and visitors should wear face coverings if tolerated. HCP should wear masks at all times, including times when interacting with coworkers and staff. Physical distancing is important in mitigating transmission, and HCP should practice physical distancing when not involved in direct patient care activities. Eye protection should be worn, and N95 or equivalent masks should be used with aerosol-generating procedures. When caring for COVID-19–positive or suspected patients, guidance from the CDC for HCP includes the use of an N95/equivalent or higher-level respirator, gown, gloves, and eye protection.¹⁷ Respirators are preferred when available.

Physical distancing is often not possible during interfacility transport, and PPE use is vitally important. Our study shows high adherence with CDC guidance for COVID-19–positive or suspected patients with > 95% use of N95/equivalent masks, > 75% use of gowns, and > 91% use of eye protection. Of note, there were no cases of SARS-CoV-2 positivity among teams who use higher-level respirators. Around 30% of teams reported the use of N95/equivalent masks for all transports, and around 50% of teams reported reusing disposable N95 masks at some point. PPE is vitally important to limit the

spread of the SARS-CoV-2 virus, and adherence to the CDC¹⁸ and AAP-SOTM² guidelines is strongly recommended during neonatal and pediatric interfacility transport by all modes. We did not identify significant deviations from the current guidelines, with the exception of reusing N95 masks. Additional efforts to supply transport teams with adequate supplies of N95 masks are critical for ensuring the safe transport of pediatric and neonatal patients with COVID-19 as well as other critical illnesses.

Airway Interventions

Respiratory symptoms are common in adults¹⁸ and children¹⁹ with more severe COVID-19. Progressive disease may lead to respiratory failure requiring intubation and/or mechanical ventilation. Additionally, the asymptomatic infection rate in children is known to be high,²⁰ and children and neonates requiring intubation for other clinical diseases may be unknowingly infected with the SARS-CoV-2 virus. Intubation is classified as an aerosolizing procedure and places HCP at high risk. Proper PPE including N95 masks, gloves, gown, and eye protection should be used during intubation.²¹ Additionally, treatment guidelines recommend the intubation of COVID-19–positive patients be performed by providers with extensive airway experience using video laryngoscopy if available.²²

Our study demonstrates a high rate of COVID-19–positive team members among teams who intubate (ground: 32%, $P < .10$) and place LMAs (ground: 34%, $P < .05$; rotor wing: 41%, $P < .10$) during transport. Precautions including the proper use of PPE and intubation by the most experienced personnel should be followed for neonates and pediatric patients requiring intubation for interfacility transport. Securing an airway for patients with a marginal respiratory status should be considered before transport in order to prevent exposure to aerosol-generating procedures in the confined spaces of transport vehicles. Planning, preparing equipment and medications, proper PPE, and safe distancing are better accomplished at referring facilities than in transport vehicles regardless of mode. Additional consideration should be given to the use of HEPA filters where possible during interfacility transport by all modes.

Limitations

Although novel in its data and critical for ensuring the safety of pediatric and neonatal transport teams, our study has some limitations. First, the approach used to capture the data (via e-mail and social media posts) limits the ability to calculate a participation rate. Although 54 individual teams responded to the survey, we know at least 110 teams are members of the AAP-SOTM. A repository for data collection specifically for the movement of COVID-19–positive or PUIs may offer additional insight over time. Second, there are data points that were not collected in this study that could be beneficial for understanding transport team practices. Questions were created based on the use of currently available guidelines (CDC and AAP-SOTM FAQ); however, the survey was limited in questions in order to obtain complete survey responses. For example, questions regarding whether parents are tested before transport could have biased downward our findings regarding infection among teams that allow parents during transport. Relatedly, the sample size was relatively small, which prevents the ability to have adjusted models of any kind. Although causality of our findings cannot be assumed, this study is the first to capture and evaluate primary data regarding interfacility transport during the COVID-19 pandemic among a large cohort of neonatal and pediatric transport teams. Third, a given transport team member responded for information about ground, rotor wing, and fixed wing teams for their facility. This could limit findings if the representative respondent was misinformed about his or her facility's patient care and safety activities for all 3 transport modes. Finally, these data were collected over a short time period and may

not reflect the safety and patient care activities among transport teams during other times of the pandemic.

Conclusions

The COVID-19 pandemic has altered the provision of health care, including the safe delivery of neonates and children to tertiary care centers by interfacility transport teams. Precautions must be taken to limit the spread of the SARS-CoV-2 virus in order for specialized transport teams to continue to provide the care needed for critically ill neonates and children during interfacility transport. Our study shows that exceptional care during interfacility transport, including a family-centered approach, can continue during the COVID-19 pandemic. Teams must take steps to protect themselves, as well as the patients and families they serve, in order to mitigate transmission of the SARS-CoV-2 virus. Hospitals should consider whether the benefits of family-centered care outweigh the cost of higher-level respirators and/or a steady supply of reusable N95 masks. Lessons learned during the current pandemic may also aid in future, unexpected widespread infectious diseases.

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